

# **PAINT and VARNISH** *Production*

THE TECHNICAL MAGAZINE FOR MANUFACTURERS OF PAINT, VARNISH, LACQUER AND OTHER SYNTHETIC FINISHES



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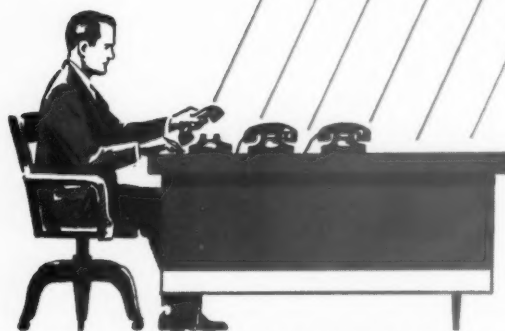
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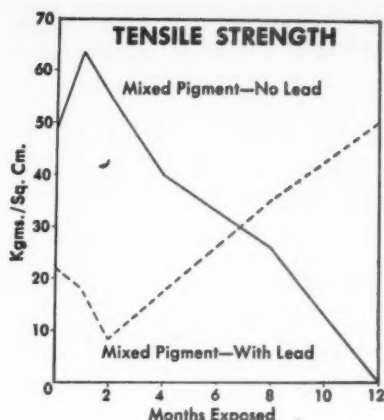
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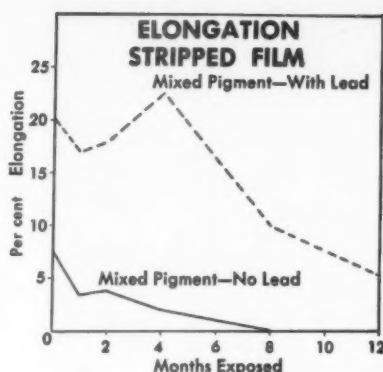


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Photomicrograph showing the meshing of the spiny lead soap crystals.



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# PAINT and VARNISH

## Production

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### NEXT ISSUE

One of the feature articles scheduled for the May issue will deal with the use of cathodic protection with conventional paint systems. It is the intent of the author to establish some of the factors to be considered in the electric degradation of the paint films which are now in common use and to encourage further development of underwater coatings to be used in combination with controlled cathodic protection.

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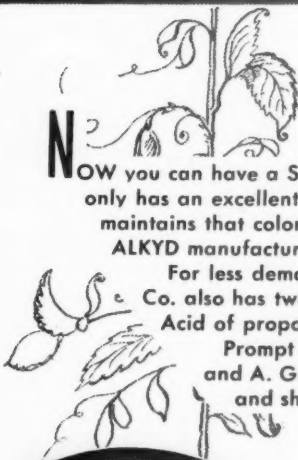
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To illustrate this change, Figure 1 shows the spectrum of a linseed oil film baked on a glass slide; the spectrum of the skin from gelatinized linseed oil and the spectrum of a baked film of gelatinized oil are also given. The lowest spectrum, A, is spectrum of the glass slide alone.

The characteristic formation of the gel peak which progresses with the formation of the insoluble state in the oil is also found in gelled alkyds, as shown in figure 2. This particular spectrum refers to a long-oil alkyd.

It can now be shown that natural waxes, in spite of their more complex composition, are capable of forming similar gels and solids. The process of doing so will be discussed later but the spectra show in the present connection that at least a considerable content of these complex, natural substances are capable of reacting similarly to that of oils and that after a certain period, the remaining crystalline impurities can be removed by solvent purification.

Figure 3 shows as an example the diffraction x-ray spectrogram of spermacetti wax. The characteristic lines are outside the range of the gel peak formations. Spectrum I is that of the pure, commercial wax. Spectrum II is its gel after solvent purification. It will be seen that the crystal lines which appear in the spectrum of the wax in its initial form have been removed in the course of gelling and solvent extraction.

It is not always easy to fully purify the gels. Figure 4 is an example of

Figure 1. Spectra plots of Various forms of linseed oil.

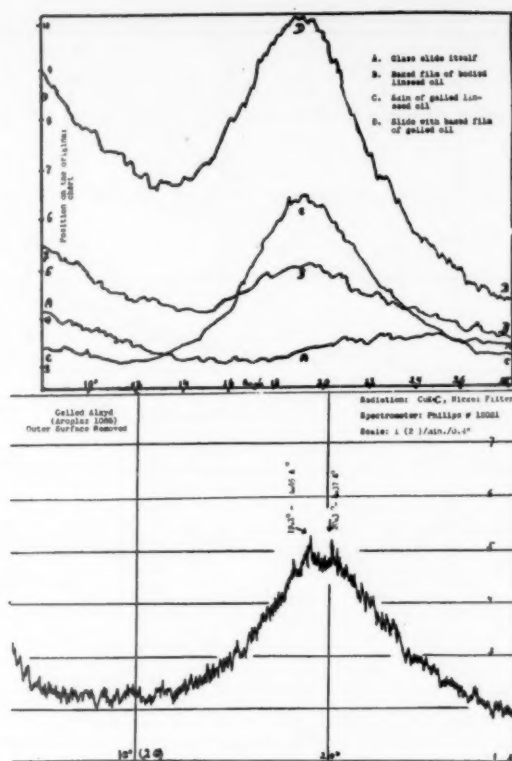
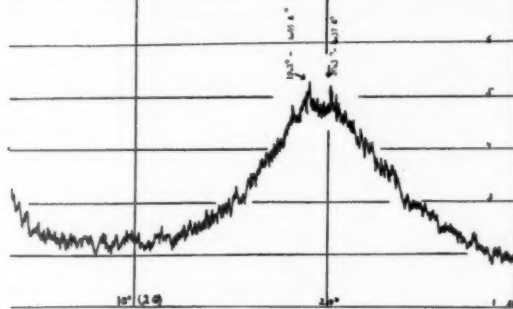


Figure 2. Diffraction X-ray spectrum of a gelled alkyd.



the behavior of beeswax gel where some crystalline impurity remains in the gel and where the crystal lines coincide with the spectrum of the gelled wax. Here the crystal matter is not a part of the gel nucleus itself, and the spectrum changes in appearance with a progressing purification of the specimen.

In the report given at the First N.Y.U. Symposium on Varnish and

Paint Chemistry, an insoluble, infusible styrene was shown which had been developed from mono-styrene in contact with insolubilized linseed oil as a seed. The grown styrene is shown in Figure 5, Spectrum A, and shows a characteristic peak formation. Spectrum B in this chart is the spectrum of the so-called "popcorn" formation which occurs accidentally under certain conditions in

Figure 3. Diffraction X-ray spectra of two forms of spermacetti wax.

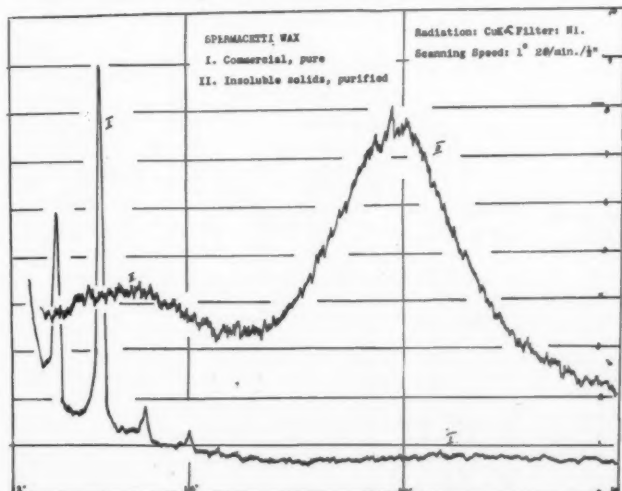
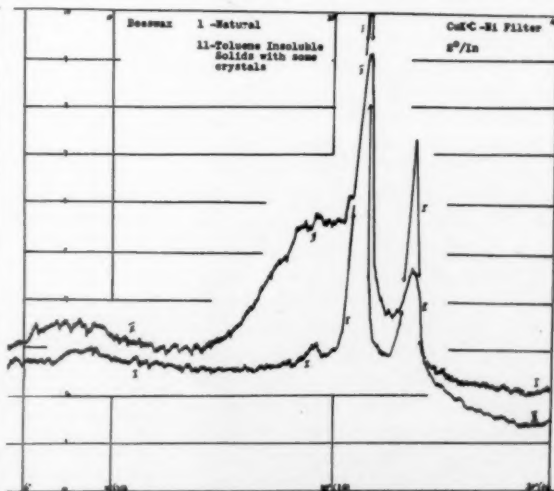


Figure 4. Diffraction X-ray spectra of two forms of beeswax.



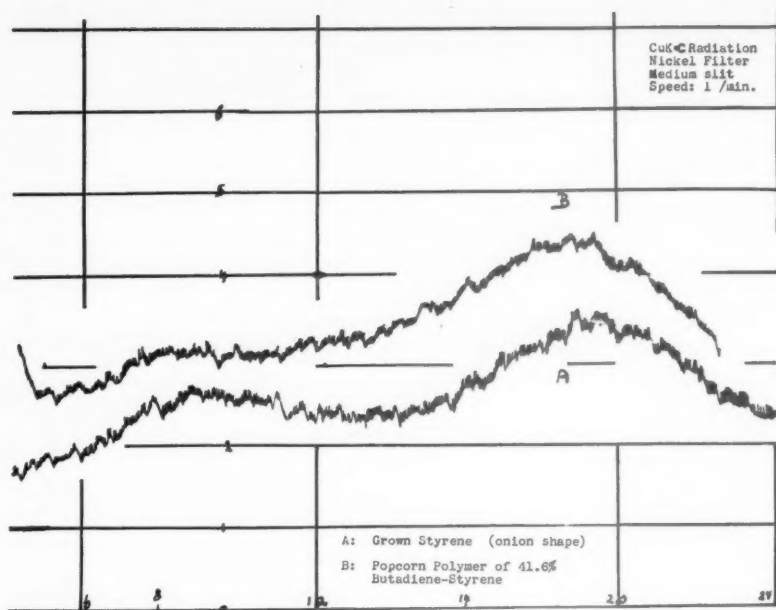


Figure 5. Diffraction X-ray spectra of styrene.

the course of synthetic rubber production. The basic difference between the two insoluble materials is in the fact that Spectrum A was derived from growth in liquid styrene while Spectrum B is an instantaneous formation caused by condensation of vapors of the monomer phase. While it is somewhat less developed than the slowly grown material, the characteristic pattern is easily noted.

Figure 6 shows the spectrum of a 12 hour, air-dried film of a methyl cellulose (a water-soluble derivative). Here in addition to the typical peak of the swelling material is another characteristic formation between  $5^{\circ}$ - $10^{\circ}$ .

The examples given here indicate the fact that the solid, swelling, three-dimensional units are not limited to oil gels but may be an essential part of many other film-forming materials also.

#### Progress Rates

THIS part is concerned with the different rates of progressing from a coherent gel state to the non-coherent solid state and their influence on the so-called "heat-resistance" of film-forming materials. The various materials which are capable of transforming themselves from a soluble or fusible state and ultimately into a non-coherent, limited-swelling, solid vary widely in the speed of formation. It has been men-

tioned before that there are some cases, like the "popcorn" formation which occurs accidentally in the styrene and synthetic rubber industry, where the initial material in its vapor phase might change directly into a non-coherent solid, and limited swelling material. In this case, the resulting product is practically free of a liquid sweller and is not capable of forming any coherent gels or coherent films.

Nevertheless it has been shown already that the x-ray diffraction spectrum of these materials shows similarities in the characteristics of a gel substance. Also, it has been shown that these "popcorns" are capable of producing a growth of insoluble, non-thermoplastic styrene when immersed in liquid styrene, in much the same way as the oil-solids and even gel-films do. In the case of oils and most other film-forming substances, which do not exist in a vapor phase (at least not without decomposition), there is a progressing transformation from a liquid to a non-coherent solid phase whereby the "as-yet-untransformed" liquid acts as a swelling agent to produce coherent gels and dry films.

Oils differ widely in their rate of forming gels, as well as in the rate of progress from the gel to a non-coherent solid. For the purposes of the coating industry that this may be utilized in the systematic production and development of gels and films of high coherence and stability.

A typical form of evaluation for this characteristic is the test on "heat resistance" of such coatings:

**Comparing Linseed Oil and Tung Oil Gelation.** It is generally known that linseed oil, when heated for a length of time, at  $280^{\circ}/305^{\circ}$  C turns into a coherent gel of rubber-like appear-

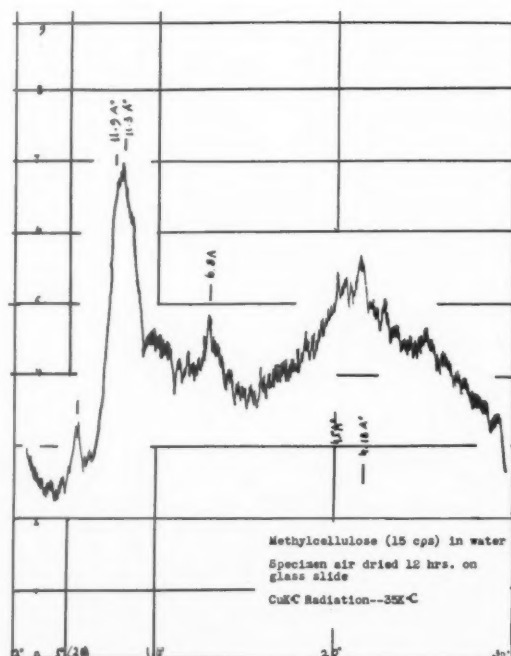


Figure 6. Diffraction X-ray spectrum of air-dried film of methyl cellulose.



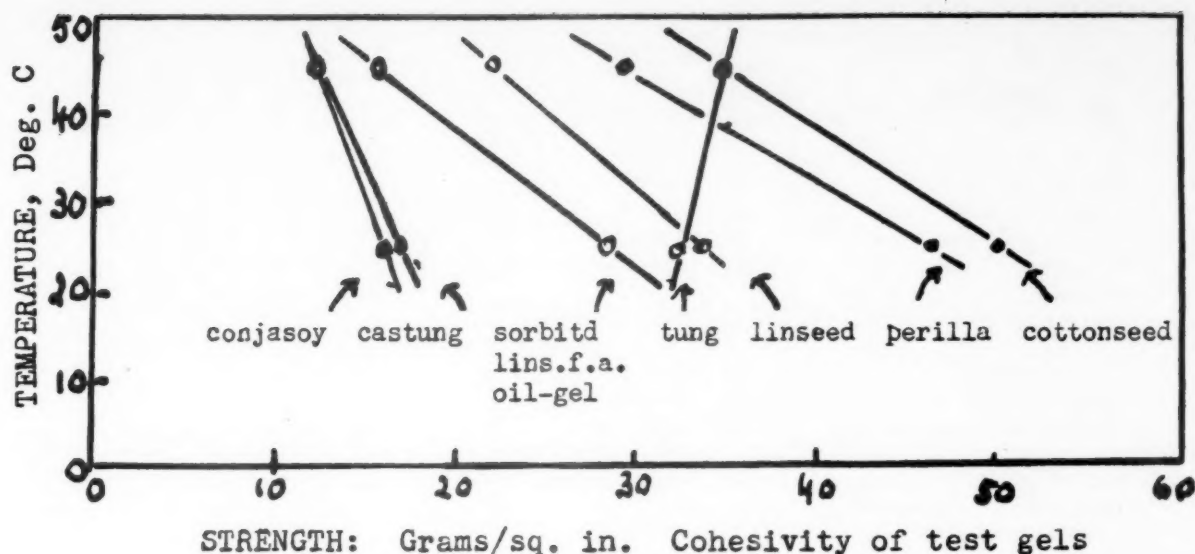


Fig. 8. Chart shows the influence of slight temperature increases on the coherence of various oil gels. Strength required to pull a standard disc out of the oil is expressed in grams/sq. in.

ance. It is hardly possible to pass from this coherent state to the very slightly colored, non-coherent, limited-swelling solid form without the use of suitable catalysts.

Tung oil, on the other hand, has a very great tendency not to form this highly coherent gel especially under heat exposure. Heating a beaker of Florida tung oil for a number of days at 100° C will result in a solidification of a transparent mass. Only the surface, which is in contact with the air in the oven forms a hard, coherent, wrinkle skin. Inside, in spite of the transparent appearance, there is an accumulation of non-coherent, almost colorless particles. This is shown in Figure 7 where the photo on top shows the underside of the wrinkled skin. The photo on the bottom shows the effect of pushing a glass rod through the oil and removing it again. Here the transparent oil has become opaque in appearance by a separation of the non-coherent particles. Allowing it to stand for a number of days, the oil particles become regrouped so that the transparent appearance will be restored. But in removing the oil-skin and separating the oxidized outside from the underside, and treating the latter three times in boiling toluene, fully non-coherent and nearly colorless small particles are obtained. The reactive qualities of this material will be shown later in this paper.

Nevertheless it is possible to produce tung oil gel in the coherent form by heating it carefully in a strong-walled container and observing its development especially around 200° C. The very early state of the formation of the coherent, stringy gel can be observed by taking a sample on the outside of a glass test tube which is water-cooled inside. In this manner, any change in the running off of the fluid oil from the glass tube can be observed. The oil can then be used in whatever gel-strength might be desired. In heating it further, the rate of stiffening would increase considerably above 230° C and this material would then show a tendency to break up into non-coherent solids under solvent treatment.

It can be observed that with the progress of stiffening or with the increase in the amount of solid phase present, the gel decreases also in its

capacity to swell as a coherent mass and becomes rather an accumulation of individual units of limited swelling capacity. The difference between the greater stability of the linseed oil gel and the tendency of tung oil gel to form an incoherent mass is in agreement with another characteristic of both oils. This is the dis-

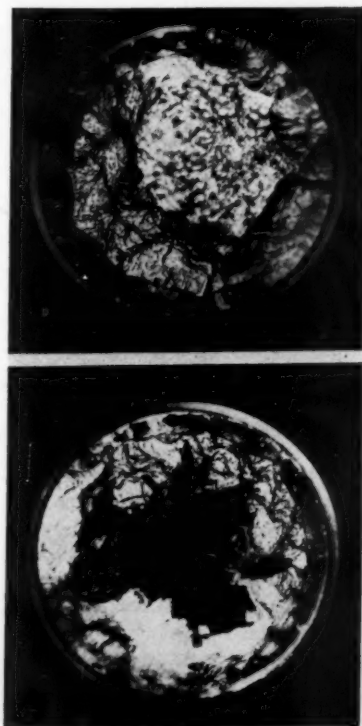


Fig. 7. Upper photo: Florida tung oil viewed through the bottom of the beaker. The oil in its solid form is transparent since the hard, wrinkled, skin at the top is visible. Lower photo: View of the same beaker of tung oil after a glass rod has been inserted and withdrawn. Displacement of the non-coherent particles gives the opaque appearance in the center. Transparency is resumed after allowing the oil to stand for a no. of days, whereby regrouping of oil particles takes place.

	MATERIAL <sup>1</sup>	TOTAL THICKNESS <sup>2</sup>	BREAKDOWN TESTED TO 5700 VOLTS	
			Tested straight <sup>3</sup>	Bend over 0.25" rod
Group 1	Silicone Varnish I.	12.1 mil	5400	0
	Silicone Varnish II.	13.5 mil	4800	1500
	Phenolic resin-Tung oil varn.	14.7 mil	above 5700	1870
	Reliquified Linseed oil gel	11.7 mil	above 5700	above 5700
	Reliquified Tung oil gel (2/3) and Linseed oil gel (1/3)	9.8 mil	above 5700	above 5700
Group 2*	Silicone Varnish I.	11.1 mil	above 5700 volt	
	Silicone Varnish II.	17.2 mil	above 5700 volt	
	Phenolic resin-Tung oil varn.	11.8 mil	4770 volt (about 400 V/mil)	
	Reliquified Linseed oil gel	9.9 mil	above 5700 volt	
	Reliquified Tung oil gel (2/3) and Linseed oil gel (1/3)	9.2 mil	3800 volt (about 410 V/mil)	

<sup>1</sup> Cured on open mesh Fiberglas.  
<sup>2</sup> Average of six measurements.  
<sup>3</sup> Average of six tests.  
\* Heated an additional 400 hours at 165–175 deg. C., tested straight.  
Group 1 heated an additional 400 hrs. at 50 deg. C.

Table 1. Electrical breakdown resistance of Fiberglas coated with different types of varnishes.

tillation number or the percent of oil substance which can be distilled off in vacuum before gelation occurs. This number in the case of tung oil is zero, but it is about 16% in the case of linseed oil. From this it can be seen that in the process of gelation, practically all the tung oil can pass ultimately into an insoluble form while in the case of the linseed oil a considerable amount of the non-insolubilized substance remains in the gel and acts as a sweller in preserving this coherent form. Oils with a still higher distillation number might result in gels with more non-insolubilized swelling substance. These will then remain soft and in extreme cases might lack mechanical strength to a considerable extent.

Another observation in this direction is concerned with the influence of even slight temperature increases on the coherence of gels. Some time ago, this factor was measured in our laboratories using a set-up similar to one used by Walter J. Hammer of the Bureau of Standards for comparing the gel strength of starches.<sup>4</sup> In this set-up, a disk was imbedded into the gel the weight required to pull the disk out, under constant conditions, expressed in weight per square inch of the disk area, was

noted. These tests were repeated under varying temperatures between the limits of 20° C and 50° C.

The results, shown in Figure 8, show that the gels which were tested indicated a lower mechanical cohesion or greater softness at increasing temperatures within these limits except the tung oil which increased in hardness under these conditions. The curves for perilla and cotton seed oil gels, compared with those of dehydrated castor oil and conjugol gel, are interesting.

**Gelling Conditions and Heat Resistance of Coating Material.** In the present consideration, it has been of primary importance to study how far the preservation or surpassing of a coherent gel state in different compounds will affect the heat resistance of these materials as coating compounds. One of the most promising approaches in evaluating this is the comparison of the electrical breakdown resistance of such films under corresponding conditions of preparation and heat exposure. This electrical breakdown resistance is highly dependent on the continuity and uniformity of the coating film.

In these tests, an open-mesh Fiberglass material (sheer marquisette

X-2445) was used after removing by burning any earlier surface treatment. Then three coats were applied from a selection of different film-forming materials. Two have been selected for comparison from the field of silicone resin varnishes (a quickly drying type but a very slowly curing type); a third material used was a commercial pure phenolic tung oil varnish, as an example of a complex organic system composed of materials of different film-forming substances. Finally two gels were reliquified in the manner as discussed earlier,<sup>2</sup> that is, one specimen was a reliquified linseed oil gel, the other a liquifaction of 2/3 tung oil and 1/3 linseed oil gel.

The three-coat system received a baking schedule of 84 hours at 100° C. At the end of this time the second silicone resin varnish was still tacky in this heavy application and received 24 hours of additional baking at 160° C. The test specimens were then divided into two groups: one group being cured for 400 hours at 50° C., the other group further cured for 400 hours at 165° C.–175° C. The specimens were then subjected to electrical breakdown test up to 5700 Volts. Any film which did not break under such exposure was assumed to be still a coherent film. The results are given in Table I.

*References will appear at end of Part Two.*

#### Epon Unit Completed By Shell

Chemical Plants Division of Blaw-Knox Company has built a manufacturing unit for Shell Chemical Corporation at Houston, Texas, to produce the new Epon resins.

Epon resins are important intermediates that are used in making improved paints, varnishes and other surface coatings. The newly completed plant was designed for maximum flexibility so that in addition to the Epon series of resins, other products can be developed and manufactured.

#### Louisville Production Club to Hear Venuto of Binney & Smith

April 18 is the date set for a talk by L. J. Venuto, Research Director of Binney & Smith Co., before the Louisville Production Men's Club. Mr. Venuto's subject is "Carbon Black and the Influence of the Vehicle as a Dispersing Medium." He will also present a summary of what has happened in Carbon Black Technology since his last talk to the group.

# Protective Coatings Research

THE Bureau of Ships of the Department of the Navy is engaged in considerable research and development in the field of protective coatings. Most of this work is carried out under the Coatings and Preservation Branch of the Research Division of the Bureau of Ships.

The Coatings and Preservation Branch is responsible for: Measures for the prevention of corrosion, deterioration, wear of ships' structures and equipment, and fouling attachment on ships' bottoms and in salt water piping systems. These measures include the application of electro-chemical principles; packaging and other forms of preservation to prevent deterioration of inactive vessels and equipment; coatings such as paints and other forms of organic preservatives in liquid form; metallic and ceramic coatings.

## Background

IF one includes the background and experience of the Bureau of Construction and Repair and the Bureau of Engineering as part of the technical heritage of the Bureau of Ships, then it may be said that there has been a "paint desk" and a paint specialist in the Bureau since 1918. To assist with Navy paint developments and standardization there has been a Paint Laboratory at the Norfolk Naval Shipyard since 1927 and one at the Mare Island Naval Shipyard since 1929. In 1935, a Paint Section was established in the Industrial Test Laboratory, Philadelphia Naval Shipyard. Records show that the Engineering Experiment Station and the Naval Boiler and Turbine Laboratory have also been called upon to evaluate paint coatings for machinery and equipment. Mention should also be made of the contributions to the knowledge about electrical insulating varnish which has come from a section in the Material Laboratory, New York Naval Shipyards.

Probably the best index of the

## BY THE BUREAU OF SHIPS

progress of the Bureau of Ships in the field of paints is the successive editions of their Painting Instructions, Appendix Six to the General Specifications for Building Vessels of the United States Navy. Therein, detail specifications for the comparatively heavy red lead paint for first coating steel (in vogue from very early days down to about 1921) may be found. The transition to the lighter weight red lead paint can be noted and the radical departure to an aluminum paint for weight conservation because of the Limitation of Armaments Treaty in 1930. Then in 1941-1942 the zinc chromate primer was introduced.

Prior to 1931, detail specifications for the comparatively heavy white lead in linseed oil paints for finish coats on both exterior and interior surfaces may be found. However, the Navy was one of the first organizations to appreciate the advantages of titanium dioxide over white lead as a paint pigment. Consequently, editions of Appendix Six beginning with that of 1931 show the use of titanium dioxide pigment in exterior gray paints and for the white

and lightly tinted paints for interiors. Many other significant changes in Navy paint compositions could be pointed out which reflect general technical progress in the industry, but the list of changes is too long for this discussion.

The Bureau of Ships has been able to take quick advantage of paint material developments offered by the industry because it maintains a competent staff and adequate test facilities at the Paint Laboratories mentioned earlier. In addition, the confidence and prestige which the Navy has built up with the industry as a progressive organization results in complete cooperation by the highly trained technicians of this competitive industry.

The technical staff of the Bureau of Ships and the laboratory personnel have had to keep abreast of paint ingredient developments, to accurately evaluate them, and to give guidance to the Naval Paint Factories in their use. The raw material manufacturers, who do much of the research and development in the paint industry, have been quite cooperative with the Bureau of Ships in keeping them informed on new and improved materials. By this flow of information the Bureau has been able to establish advantageous changes in their paint standards within a comparatively short period.

In the field of ship bottom paints, the Bureau of Ships has been pre-eminent for many years. Shipbottom paints embody principles of formulation quite different from those governing the production of paints for atmospheric exposure. Continuous submergence in water is not ordinarily expected of a paint film. Bottom paints for wooden hull vessels are expected to help prevent the entrance of teredo and other species

Editor's Note: Paint and Varnish Production takes pleasure in presenting this detailed study and survey on the research activities of the Government Agencies. The cooperation and assistance of the Government personnel in making this series possible is deeply appreciated.

Although this article by no means covers the full activities of the Coating and Preservation Section and the work being carried out in the field laboratories, space limitations do not permit a more extensive or detailed account. It is believed, however, that the above material describes the major activities of the Bureau of Ships in the field of Protective Coating Research.



of marine borers into the wood and to prevent the attachment of barnacles and other fouling attachment and to protect the steel against corrosion.

The Bureau has been continuously engaged in shipbottom paint development since 1908. At that time, it brought out the shellac type anti-corrosive and antifouling paints as Navy standards, based upon the results of tests conducted at the Norfolk Naval Shipyard. The work had been carried out under Mr. N. E. Adamson who was the Navy's leading authority in this field for many years. These shellac paints continued as standards until 1925 when they were supplanted by the coal tar-rosin base products as the result of tests at Norfolk and Beaufort, N. C., and service tests on ships. The "plastic" paint phase, in which the Navy is now engaged, began with a program of extensive test evaluation in 1932.

Early experience in the use of Navy paints indicate the importance of surface preparation. This is shown in the use, for many years, of the acid pickling process for removing mill scale from hot rolled steel, and in the use of wet sandblasting as a preliminary step for the application of "plastic" paint systems to ships' bottoms.

From experience in the early days of the World War II, an intense interest arose in determining what could be accomplished in improving the fire retardant characteristics of the paints used on interior surfaces of Naval vessels. Fire in one compartment could readily propagate from compartment to compartment, by ignition of the thick paint films on the bulkheads, at a comparatively low temperature. After extensive investigation, it was found that an acceptable degree of fire retardance in an interior paint could be achieved by reducing to a bare minimum, consistent with washability, the amount of readily combustible material in the film. Then additional fire retardance was obtained by including some antimony oxide in the pigment portion. This ingredient seems to reduce appreciably the tendency for the applied film to form large blisters that entrap dangerously combustible gases which explode on a small scale. These changes in formulation, with a pigment combination that yields a white or lightly

tinted paint, comprises the present standard finish for most interior surfaces.

#### Research Programs

**Surface Preparation:** A program is underway to obtain more conclusive data as to comparative effectiveness of dry blasting with rock granules and wet sandblasting. Several ships' bottoms are being cleaned with granulated rock material for application of "plastic" paints. The ships will be service tested in comparison with bottoms prepared with wet sandblasting and coated with the same plastic paints. Particular attention will be given to comparative costs, effectiveness, durability, and other pertinent data.

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Modification or development of new principles in the construction of flame spray equipment that will make it economically feasible to apply hot melt plastic composition to ships' bottoms are also being investigated.

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of marine borers into the wood and to prevent the attachment of barnacles and other fouling attachment and to protect the steel against corrosion.

The Bureau has been continuously engaged in shipbottom paint development since 1908. At that time, it brought out the shellac type anti-corrosive and antifouling paints as Navy standards, based upon the results of tests conducted at the Norfolk Naval Shipyard. The work had been carried out under Mr. N. E. Adamson who was the Navy's leading authority in this field for many years. These shellac paints continued as standards until 1925 when they were supplanted by the coal tar-rosin base products as the result of tests at Norfolk and Beaufort, N. C., and service tests on ships. The "plastic" paint phase, in which the Navy is now engaged, began with a program of extensive test evaluation in 1932.

Early experience in the use of Navy paints indicate the importance of surface preparation. This is shown in the use, for many years, of the acid pickling process for removing mill scale from hot rolled steel, and in the use of wet sandblasting as a preliminary step for the application of "plastic" paint systems to ships' bottoms.

From experience in the early days of the World War II, an intense interest arose in determining what could be accomplished in improving the fire retardant characteristics of the paints used on interior surfaces of Naval vessels. Fire in one compartment could readily propagate from compartment to compartment, by ignition of the thick paint films on the bulkheads, at a comparatively low temperature. After extensive investigation, it was found that an acceptable degree of fire retardance in an interior paint could be achieved by reducing to a bare minimum, consistent with washability, the amount of readily combustible material in the film. Then additional fire retardance was obtained by including some antimony oxide in the pigment portion. This ingredient seems to reduce appreciably the tendency for the applied film to form large blisters that entrap dangerously combustible gases which explode on a small scale. These changes in formulation, with a pigment combination that yields a white or lightly

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sistent with desirable re-activation practices on current rust preventives, and to develop new rust preventives which will be formulated for easy removal by means of low cost materials and methods.

3. Determine the possibilities of widening the scope in the use of available and newly developed materials considering problems such as compatibility with products of combustion, adjacent packaging materials, and service lubricants which follow depreservation.

4. Evaluate approved rust preventives and proprietary compounds as rust-arresters for metal already corroded.

5. Develop new or revised specifications, and qualification test thereunder.

6. Develop methods for identifying preservative compounds by types both in the container and after prolonged exposure on preserved surfaces.

Laboratory evaluations including panel exposures and service tests of existing and experimental coatings will be made. These experimental coatings will be either industrial offerings or coatings formulated by the laboratory from new or improved ingredient materials.

#### Ceramic Coatings for Mufflers

**B**ECAUSE simulated service testing procedures for the evaluation of ceramic coatings on mufflers is of considerable duration, it is not adaptable to lot acceptance inspection. With the announcement of any procurement program of significant interest, it is anticipated that numerous requests for brand approval would be received. It is believed that requirements for visual examination of porcelain coated exhaust mufflers can be based on existing information in the Bureau's records. Additional quantitative data are necessary for setting technical requirements for thickness, and coverage or continuity of coating. Therefore, it is the purpose of this project to obtain such data and develop inspection procedures to set adequate specification requirements for ceramic coatings.

Comparison of porcelain coatings which have demonstrated themselves

to be satisfactory and unsatisfactory as a result of simulated service and actual duty service tests will be conducted as follows:

1. **Corrosion protection.** Among other possible methods, the Pfaudler Cup system and other reflux procedures will be evaluated.

2. **Thermal shock.** The adequacy of existing standard test procedures will be determined.

3. **Thickness.** The various methods of indicating thickness will be evaluated and the influence of thickness on corrosion protection and resistance to thermal shock will be determined.

4. **Coverage and continuity of coating.** The various methods of indicating coverage will be evaluated and the influence or completeness of coverage on corrosion protection and resistance to thermal shock will be determined.

#### Ceramic Coatings for Submarines

**E**NGINEERING properties of ceramic coatings are influenced by formulation, method of application, and thickness, among other factors. The extent to which a porcelain enameled steel surface can be repaired, or coated locally, such as by the use of flame spraying equipment, depends upon the size and shape of the object being coated as well as the formulation of ceramic materials. It is one of the objectives of this project to determine the suitability of various ceramic coatings, such as proposed from time to time by commercial firms, for specific submarine items. It is another objective of this project to develop materials and techniques for the application of such coatings by means of powder-type spray equipment.

The application of ceramic coatings requires heat sufficient to bring the surface of the metal within the maturing temperature range of the porcelain. Commercially this is accomplished in furnaces of sufficient size to accommodate the entire object being enameled. Relatively small objects can be flame enameled successfully because all surfaces can be practically uniformly heated simultaneously. Relatively large objects require such meticulous control of

the temperature that localized repair is not practical in the present state of development. Supplementary heat in the form of exothermic energy appears to offer promise, if the reaction mixture can be so formulated as to form ceramic coating substances as the reaction products without the evaluation of gas.

This project is at present divided into three problems, namely: I. Exploration of exothermic ceramic forming mixtures; II. Evaluation of equipment and techniques for local application of self-fusing ceramic coatings, and III. Applicability and serviceability of commercially available porcelain enamel coatings and processes.

The approach to Problem I centers on a continuation of exploration of exothermally reacting mixtures which theoretically offer promise in the formation of ceramic substances of probable suitability for coated steel surfaces.

Phase II involves a continuation of Laboratory evaluation studies of flame spraying equipment commercially designated as powder-type, spray-metallizing outfits; with particular reference to their suitability for the application of ceramic coatings to submarine parts.

Phase III will determine the applicability and serviceability of ceramic coatings of the porcelain enamel type on various submarine parts.

#### Ceramic Lined Pipings

**A** THOROUGH study of the behavior of porcelain enamel coatings on the inside surface of steel tubing is necessary to determine the suitability of such materials for shipboard use. Suitability for shipboard use includes ability of such tubing to be bent and joined. Preliminary tests have indicated that formulation of coating, thickness of coating, and temperature of bending influence the ability of the internally coated tubing to be fabricated into the necessary shapes. In addition, joint design and methods of enameling influence the ability of this tubing to be installed in a shipboard system.

(Turn to page 26)





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Besides exposure to sunlight, rain, heat, cold, industrial fumes and salt air, the coating on this hopper car frequently gets pounded with sledge hammers to loosen up cargoes.

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weather and physical abuse, coatings based on VINYLITE Resins are virtually unaffected by alkalis, most strong acids, oils, greases, industrial fumes, smoke, brine, and most other chemicals.

Available in a wide range of colors, they are applicable to metal, masonry, or concrete. They do not chip, crack, or peel, maintaining integrity and bond for long periods. Odorless and tasteless, they protect containers from product attack, and products from container contamination.

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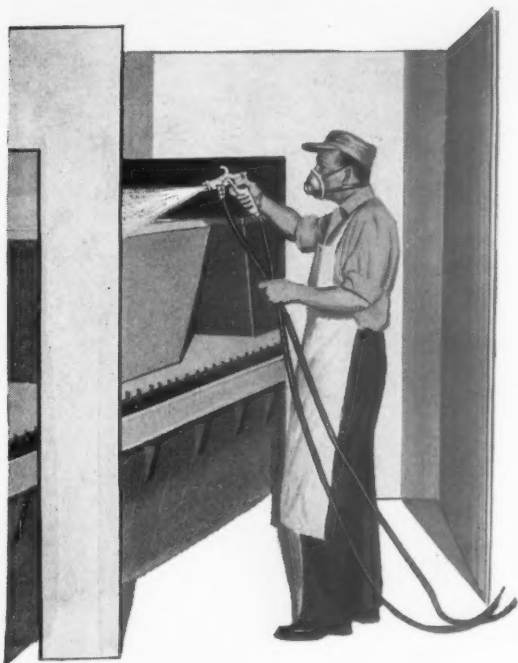
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# Comparative Bulk Oxidation of Drying & Non-Drying Oils

By P. S. HESS and G. A. O'HARE

Congoleum-Nairn, Inc.

VARIABLES encountered in the mechanical bulk oxidation of vegetable oils may be classified as those directly related to the manufacturing process employed and those which are inherently related to an individual oil. In production, therefore, the latter variables may be considered secondary since the overall effect on the course or the product of the reaction for any one oil is directly related to the physical conditions chosen for the reaction. This should not be interpreted to signify that these inherent variables are of less importance; it means, however, that for any given oil definite and important variables are encountered during processing which are independent of composition.

## Variables

THE variables having influence on the physical behavior or speed of reaction of any given vegetable oil upon oxidation in bulk are: (1) air flow, (2) turbulence (degree and type of agitation), and (3) reaction temperature which affects both physical and chemical changes.

Probably the most important single factor influencing the nature of the product is the glyceride composition. Other conditions which affect the performance of any one oil and which must be considered in any evaluation thereof are the history of the oil itself, such as geographical origin, the method of expelling from

the seed, length of oil storage as well as methods of treatment such as alkali or acid refining, bleaching, and catalysis.

This paper will concern itself for the greatest part with differences in oxidation behavior due to composition. Emphasis will be placed upon such commonly used oils as linseed, soybean, dehydrated castor, and tung oil. Safflower and segregated soybean oil which promise to become of industrial importance as well as some non-drying edible oils (olive, cottonseed, peanut) will be discussed also.

For purposes of background information it seems advisable to review the effects which air flow, agitation, and temperature exert on any one oil.

## Air Flow

*Experimental Procedure*—The apparatus used and the methods of analysis have been described elsewhere<sup>1</sup>. No drier or other catalytic agents were used in any of these experiments.

The effect of the quantity of air introduced into the reaction vessel were determined by keeping temperature and agitation speed constant. The following conditions were imposed.

Oil Used	500 g. of raw linseed oil
Temperature	110°C.
Agitation	1060 r.p.m. (832 f.p.m.)
Air Flow	0.01, 0.04, 0.08 and 0.12 c.f.m.

Figure 1 demonstrates that during the early stages or during the period

generally called the induction period, no viscosity increase of the oil can be noted. Actually it has been determined that during this period a continuous viscosity increase does occur, but this is so slight as to be imperceptible if ordinary measurements are employed. Similarly, refractive index, color, oxygen content, dielectric constant, power factor, and iodine value are only slightly affected during the induction period. The fact that real physical and chemical changes do occur during this period has been verified by ultraviolet absorption measurements since the entire absorption curves are progressively displaced to higher values, as well as changes in peroxide value of substantial magnitude. It is illustrated in Figure 1 that the induction period terminates sharply and at the same time regardless of the air flow. Thereafter, the reaction rate (viscosity pickup) becomes a function dependent on the air flow rate and the greater the air flow, or perhaps more correctly the greater the ease of establishing contact between the air-oil interface, the greater the change in the reaction rate.

## Effect of Agitation Rate

EFFECTS of agitation rate differences were followed by keeping temperatures and air flow constant at 110°C. and 0.12 c.f.m., respectively. Experiments were run at 1272, 1060, 892, and 686 stirrer revolutions per minute. This corresponds to an impeller tip speed of 1000, 832, 696, and 538 feet per minute.

Figure 2 shows that an increase

Presented for the Co-ordinating Committee of the New York Paint and Varnish Production Club and the New York Paint, Varnish and Lacquer Association at the Third Varnish and Paint Chemistry Symposium sponsored by the College of Engineering of New York University on November 18, 1950.

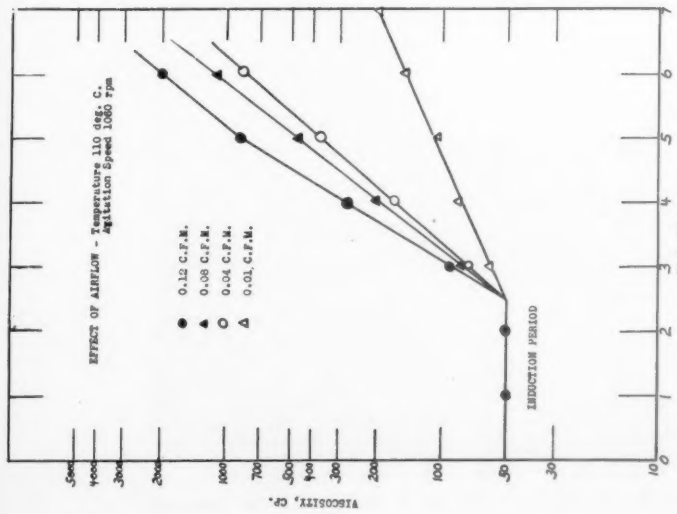


Figure 1

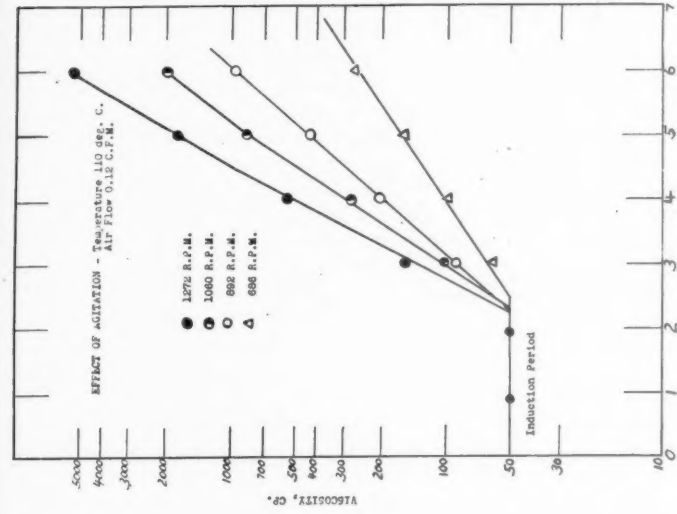


Figure 2

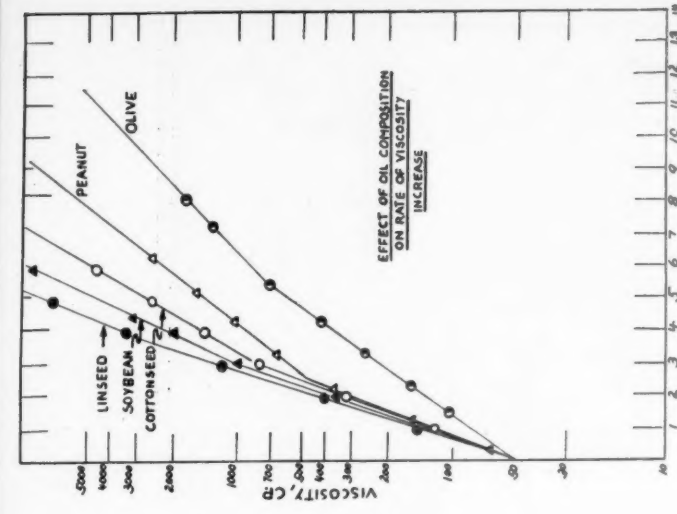
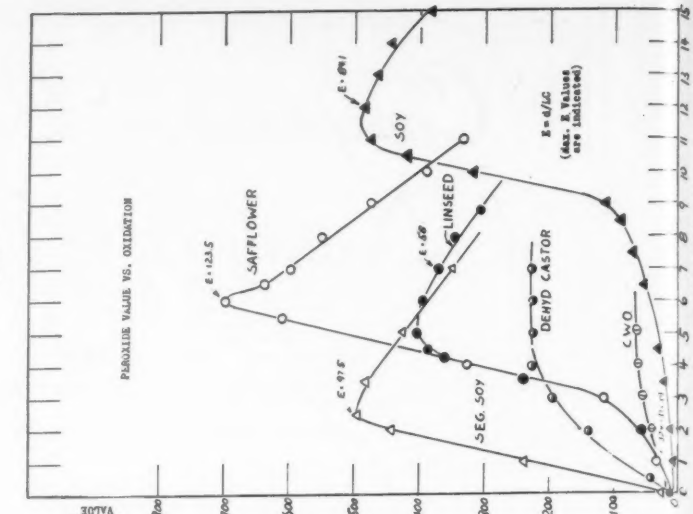
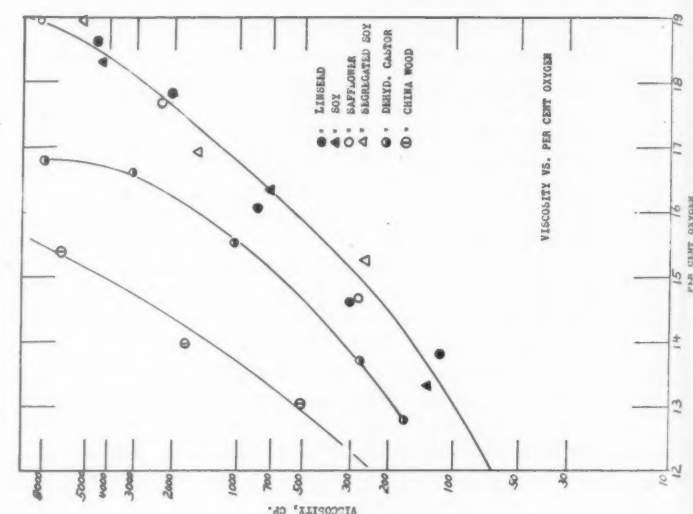
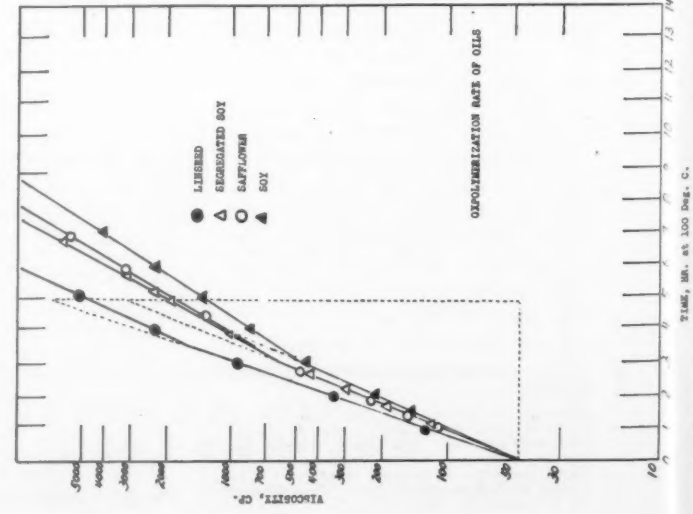


Figure 4





in the agitation speed increases the rate of reaction, not, however, until the induction period has been eliminated. This is similar to the effect which air flow exerts on the oxidation process. In general, the results obtained by increasing the agitation speed are concurrent to those obtained by increasing the amount of air entering into the system. Experience has shown that, under these conditions, agitation has a more pronounced effect on reaction rate than air flow, provided a required minimum of air is present. It may be surmised, therefore, that the degree of turbulence which influences the ease of oxygen addition at the air-oil interface is by far the more important factor in accelerating the reaction than the quantity of air introduced once the threshold quantity sufficient to satisfy the reactive centers of the oil molecule has been exceeded.

The same relationships exist between viscosity, per cent oxygen uptake, dielectric constant, refractive index, and other constants regardless of air flow or agitation at any one temperature. This indicates that differences in air quantity and agitation on the bulk oxidation of any one oil are mainly physical in nature and do not effect the ultimate product.

#### Effect of Temperature

**T**HE effect of temperature on the induction period and on the bulk oxypolymerization of raw linseed oil

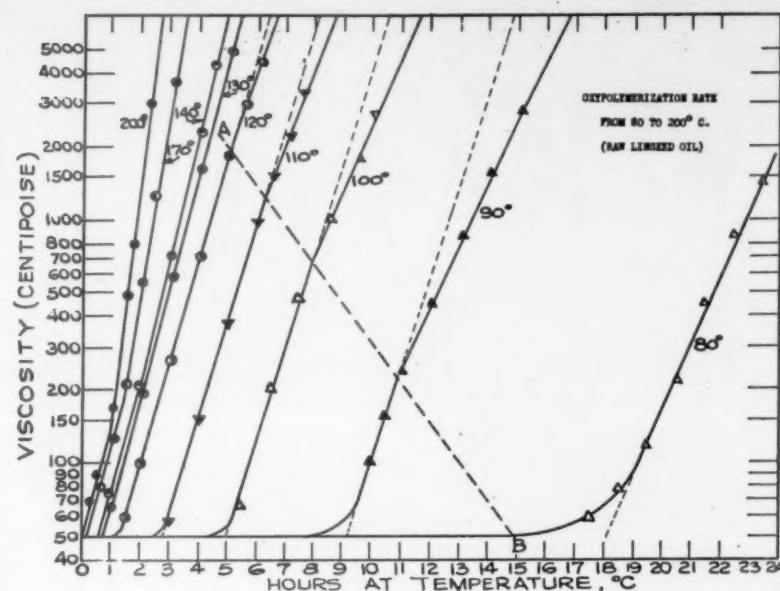


Figure 3

under otherwise constant conditions of air flow and agitation has been discussed in detail in an earlier publication<sup>1</sup>. Figure three illustrates that within the temperature range of 84 to 200°C. the initial rate of viscosity increase is identical for all temperatures. At a definite point in the oxidation, a change in the rate of viscosity increase occurs. The existence of this rate change has made it possible to show that there are at least three distinct temperature regions, each characterized by different types of oxidative changes.

They are: above 130°C. between 84° and 130°C., and below 84°C.

Temperature has a distinct effect on induction period length. In the intermediate temperature range, the length of the induction period decreases exponentially with unit increase in temperature. At 130°C. and above, the induction period is of very short duration. During the initial stages of the oxypolymerization reaction the peroxide value increase is independent of the temperature in the 84° to 200°C. range. The maximum value, however, is a definite function of temperature; higher values correspond to lower reaction temperatures. Ultraviolet absorption analyses indicate that the formation of diconjugated systems reaches a maximum and that at temperatures between 84° and 200°C. the diene configuration as determined by the characteristic inflection at 232 mμ is never appreciably greater than 5%. Higher values are obtained at lower reaction temperatures. The results obtained are in agreement with the free radical propagation theory of oil oxidation and appear to indicate the formation of an intermediate prior to oxidative molecular weight build-up.

#### Effect of Composition

**I**N THE conventional classification of the fatty oils into non-drying (Turn to page 24)

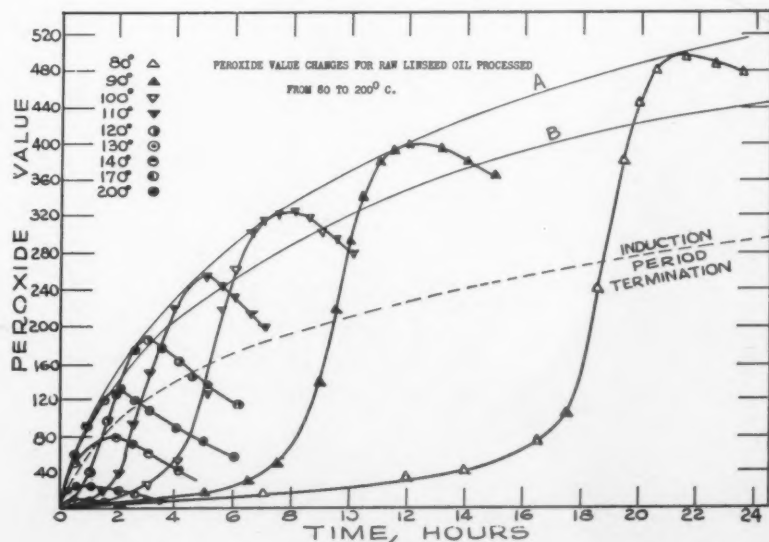


Figure 7

# wide open

for the closest inspection,

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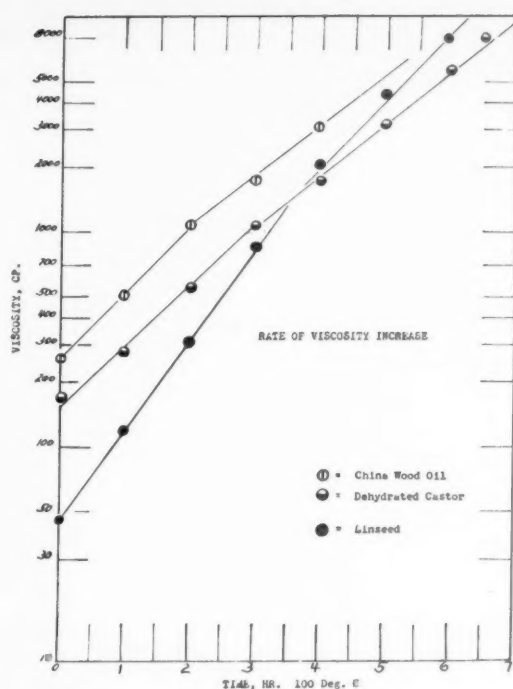


Figure 9

and drying oils, the latter are characterized by their ability to absorb oxygen from air and to form "dry" or coherent films when exposed in thin layers. This property, as all other physical and chemical behavior, is dependent on (1) the complexity or functionality of the oil molecule and (2) the degree and type of unsaturated fatty acids making up the triglyceride. Experimentally it has been shown that a "trifunctional" molecule, i.e. a glyceryl ester, is the minimum requirement for a satisfactory drying oil. All natural vegetable oils belong in this class. Of equal importance as the polyfunctionality of the drying oil molecule is the composition of the fatty acid component.

Natural oils are composed of the glycerol esters of a variety of acids which vary mainly in the number and position of their carbon to carbon double bonds and are almost exclusively members of a series containing eighteen carbon atoms. The degree of unsaturation is important, since the drying speed and the rate of polymerization are greatly dependent upon the structure of the constituent fatty acids.

#### Bulk Oxidation Behavior

THE section deals principally with the effect that fatty acid composition as existent in natural oils

has on the mechanical bulk oxidation of oils.

**Comparison of Drying and Non-Drying Oils**—Cottonseed, peanut, and olive oils were blown at 1060 rpm., 0.12 c.f.m., and 120°C. It is most probable that these oils were alkali refined and bleached for edible purposes. They were compared against raw linseed and degummed soybean oils blown under the same conditions. This comparison is perfectly adequate since the only effect of alkali refining on the rate of viscosity increase is a shortening of the induction period.

The purpose of these experiments was to compare under identical conditions oils which vary considerably in their fatty acid constitution.

Approximate fatty acid contents are reported in the literature (See Table 1).

The viscosity increase of these oils is plotted in Figure 4. Induction

periods have been eliminated from this figure. It is significant that there is initially only a little difference in the rate of viscosity increase with the exception of olive oil. The rate, however, does increase with an increase in unsaturation. The differences in rate become more pronounced after the point at which the rate changes and, here again, the greater the unsaturation, the greater the rate.

The similarity in the initial reaction rate among linseed, soybean, cottonseed, and peanut oils, in spite of the large quantitative difference of linolenic and linoleic components, leads to the conclusion that the initial rate of reaction is governed by these constituents, with each having about the same potential for furthering the reaction. This leads to the further conclusion that the reaction rates of linolenic and linoleic components on bulk oxidation are the same. This is contrary to the behavior of these components during thermal polymerization where the linolenic has been shown to be much more reactive.

The oleic segment is less prone to further molecular weight build-up and for this reason, since olive oil is predominantly composed of oleic segments, the rate of increase is slower for that oil. This reasoning may also be applied to the larger differences in rate after the rate change point if the assumption is made that the combined linolenic and linoleic constituents are preferentially used up in forming the oxypolymer.

**Comparison of Drying Oils**—Commercial raw linseed oil, degummed soybean, solvent segregated soybean oil, and safflower oil were bulk oxidized to the gel stage at 100°C., 1060 r.p.m. and 0.12 c.f.m. The course of the reaction was followed by measurements of viscosity, color, refractive index, acid value iodine value, per cent oxygen uptake, and

	Linseed	Soybean	Cottonseed	Peanut	Olive
Linolenic	45-55	2-6	---	---	---
Linoleic	15-25	45-55	40-50	20-25	5-8
Oleic	15-25	30-35	25-30	55-65	75-85
Saturated and lower chain fatty acids	8-12	5-15	15-25	5-15	5-15

TABLE 1

ultraviolet absorption. Table 2 represents the physical and chemical characteristics of the original oils. Per cent composition was determined by ultraviolet absorption<sup>2</sup>; those of safflower oil are accepted from the literature.

Ultraviolet analysis showed that none of these oils possessed conjugated linkages.

The process of solvent segregation involves the removal of the more highly saturated molecules from the oil. In this manner, the iodine value is raised implying that the per cent fractions of the linoleic and linolenic fatty acid segments is increased. In other words, the quantity of reactive groupings capable of promoting molecular weight increase is higher than those present in the original oil. During the process minor oil components acting inductively on the glyceride are also removed as is partially evidenced by improved color.

Safflower oil, said to have properties approaching those of linseed, has recently come into prominence as a commercial product. Its chemical constitution is entirely different; the percentage of the linolenic acid component is very low and of the order of not over 2 or 3 per cent. The per cent of linoleic acid component, however, is high. Consequently, the quantity of reactive groups, according to data presented earlier, approaches that of linseed oil. Spectrophotometric and other data indicate that the oil used was a raw oil obtained perhaps by a mechanical extraction procedure.

In Table 3 pertinent data relating to the oxidation of these oils have been summarized.

**Viscosity**—In Figure 5 the viscosity is plotted logarithmically against the time of oxidation at 100°C. for the respective oils. The various induction periods have been omitted in this plot. It is indicated that the initial rates of viscosity increase are of the same order.

	Linseed*	Soy*	Segregated Soy*	Safflower
Linolenic	51.	8.0	13.2	0-2
Linoleic	14.8	52.3	58.9	72-76
Oleic	22.7	24.2	16.3	20-30
Saturates	11.5	15.5	11.6	5-7
Color	10 +	11 +	9	10
Nd <sub>25</sub>	1.4789	1.4730	1.4763	1.4746
Per. Val.	28.0	4.62	7.45	9.55
Acid Val.	2.0	1.2	1.7	2.4
Iodine Value	177	131	150.5	145.3
% Oxygen	11.82	11.50	11.68	10.84

\* Samples and per cent analyses were furnished by the Pittsburgh Plate Glass Co.

TABLE 2

All natural oils exhibit a change in the rate of viscosity increase, at a certain viscosity the rate of reaction decreases in the specified temperature range of 130°C. to 84°C. This rate change is significantly different for the various oils at any given temperature in this range. The rate of viscosity increase after this change decreases with a decrease in iodine value.

No correlation has as yet been found between the amount of oleic acid segment in the molecule and the initial rate of viscosity increase. It seems from the data that increasing amounts of oleic and saturates do adversely effect gelation time. The overall reaction rate, exclusive of physical factors, appears to depend mainly upon (1) the quantity of reactive components, i.e. the combined amount of linolenic and linoleic acid segments, and (2) the molecular or stearic configuration of the individual triglyceride. The latter determines the ease with which oxygen can react and propagate molecular weight increase.

**Evaluation of Usual Constants**—At equivalent viscosities the color of the blown soybean oils and safflower oil was approximately the same but better than that of linseed. This points out that the presence of large quantities of the linolenic component dis-

colors an oil more rapidly on oxidation than diethenoic components.

The development of acidity appears to be mainly a function of (1) the molecular configuration of the molecule and (2) the quantity of the monounsaturated and perhaps saturated constituents.

During the oxypolymerization the gain in refractive index units at 10,000 cp. was approximately 0.0080 for all oils. More than half of this rise was attained at an average viscosity of 300 cps.

The iodine value drop was somewhat greater for linseed oil (75 units at 5000 cps.) than for the soybean and safflower oils (60 units at 5000 cps.). Similar to the refractive index values, the greatest drop occurred before 300 cps. was reached.

The per cent oxygen increase with increase in viscosity is demonstrated in Figure 6. A relationship exists apparently between the logarithm of the viscosity and the percentage of oxygen in the molecule. At any given viscosity the quantity of oxygen is indicated to be of the same order for these oils. From this the conclusion may be drawn that during oxidation the viscosity is directly dependent on the amount of oxygen that has been absorbed by the oil at the stated conditions.

**Peroxide Value**—Figure 7 points out the fact that the rate of peroxide value increase in the initial stages of the oxypolymerization reaction is a function independent of temperature in the 80° to 200°C. range. For this same temperature area it has also been found that the initial increase in peroxide value is of the same order for other unconjugated drying and non-drying oils (Figure 8). The maximum value, however,

	Induction Period-hrs.	Time to 1000 cps. (less induction period)	Time to 5000 cps.	Total Time to Gel
Linseed Oil	3	3.1	5.2	10.
Soybean	9.2	4.6	7.6	16.5
Segregated Soy	0.5	4	6.8	12
Safflower	3.8	4.1	6.9	12.2

TABLE 3

Comparison of Maximum Peroxide Value with  
Maximum Absorption at 232 m $\mu$

	% Linoleic	Viscosity	Maximum Peroxide	E at 232 m $\mu$	% Conju- gation
Linseed	14.8	300	403	54.5	4.74
Soybean	52.3	395	485	84.1	7.31
Segregated Soy	58.9	260	495	97.5	8.48
Safflower	72-76	275	697	123.5	10.74

TABLE 4

is a definite function of temperature; higher values correspond to lower reaction temperatures.

The maximum peroxide value attainable is dependent on composition as well as temperature. As the unsaturation of an oil decreases, higher maxima are reached. A notable difference exists, however, for oils which have conjugated bonds. There the initial rise is actually slower and no definite peaks are observed. Upon reaching a maximum, the peroxide value remains at the same level over a large viscosity change. This, in conjunction with other data, definitely indicates that bulk oxidation for conjugated oils follows a different mechanism than that of nonconjugated oils. This will be discussed later in greater detail.

It was observed that for non-conjugated oils the maximum peroxide values were attained at approximately 300 cp.; at this viscosity the overall change in refractive index, iodine value, and per cent oxygen was approximately 50% of the total changes which take place up to gelation.

**Ultraviolet Absorption Analysis**—The absorption spectra of the raw oils were characteristic with the exception of the segregated soybean which displayed an absorption maxima in the 272 m $\mu$  region typical for triple conjugated bonds. None of these oils exhibited peaks at 232 m $\mu$ ; consequently no double conjugated fatty acid segments were present. Upon reaction with oxygen typical curves were obtained displaying peaks characteristic of double conjugation.

Maximum absorption at 232 m $\mu$  was observed at the point where the soybean oils and safflower oil reached their maximum peroxide. This was not true for linseed oil; there maximum absorption occurs after the

maximum 232 m $\mu$  has been attained. (Figure 8).

The data in Table 4 suggests that for oils having a linoleic acid content of more than 50% and which are comparatively poor in the linolenic constituent, a relationship exists between the absorption value at 232 m $\mu$  at the maximum peroxide and the quantity of linoleic component present. The correlation between peroxide value and absorption at 232 m $\mu$  suggests further that absorption at this wavelength is a function of conjugation involving oxygenated structures rather than carbon to carbon linkages. Possible structures of conjugated hydroperoxides and others have been proposed earlier.

**Comparison of Linseed, Dehydrated Castor, and Tung Oil**—It is generally believed that the rate of viscosity increase of conjugated oils upon oxidation is faster than that of the other drying oils. Figure 9 illustrates that that is not actually so. The rate of increase is greater for linseed oil than either China wood oil or dehydrated castor oil. The overall time required, nevertheless, to reach a certain viscosity may be less for the latter oils. This can be accounted for by two facts:

1. The initial viscosity is greater than that of linseed.
2. China wood oil and dehydrated castor oil have no induction periods.

It appears that the oxidation reaction mechanism for conjugated oils is different as may be concluded from the ultraviolet and the shape of the peroxide value curves.

In the case of conjugated oils maximum diene configuration is present in the original oil. Upon oxidation a constant decrease occurs. The rate of peroxide value increase for these oils does not correspond to

that of other vegetable oils examined and the maximum value is of much lower magnitude (Figure 8). Similarly, the quantity of oxygen absorbed at any specific oxidation time is also less than that of the oils having isolated carbon double bonds. This, however, is most probably due to initially different viscosities. Upon superimposition of the oxygen curves to the same initial viscosity, no significant differences in the rate of oxygen absorption with rise in viscosity can be detected for China wood, dehydrated castor, or for the oils containing isolated carbon to carbon linkages only.

The presented data suggest the following:

1. The linolenic and linoleic segments of a triglyceride molecule behave similarly upon oxidation in bulk.
2. Differences in oxidation behavior, however, are noted for the oleic, elaeostearic, and 9, 11 linoleic constituents.

#### References

1. Hess, P. S., and O'Hare, G. A., I. E. C. 42, 1424 (1950).
2. Samples and per cent analyses were furnished by the Pittsburgh Plate Glass Co.

#### PROTECTIVE COATINGS

(From page 16)

#### Personnel

The civilian leader of the Coatings and Preservation Branch of the Research Division of the Bureau of Ships is Mr. D. P. Graham. He is assisted by Mr. P. M. Van Etten on Organic Coatings, Mr. F. E. Cook and Mr. L. M. Newman on Preservation including temporary preservatives, and Mr. F. B. Nagley on Metallic and Ceramic Coatings.

Commander F. H. Huron is the military head of the section with Lt. Commander W. S. Humphrey as assistant. The mailing designation for the Branch is Code 347, Bureau of Ships, Dept. of Navy, Washington 25, D. C.

The field personnel are as follows: Mr. W. W. Cranmer, Chief, Paint Section, Industrial Test Laboratory, Philadelphia Naval Shipyard, Philadelphia, Pennsylvania; Mr. W. G. Francis, Chief, Paint Laboratory, Norfolk Naval Shipyard; Mr. J. Saroyan, Chief, Paint Laboratory, Mare Island Naval Shipyard, Vallejo, California.





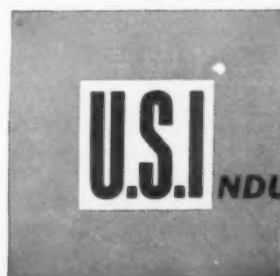
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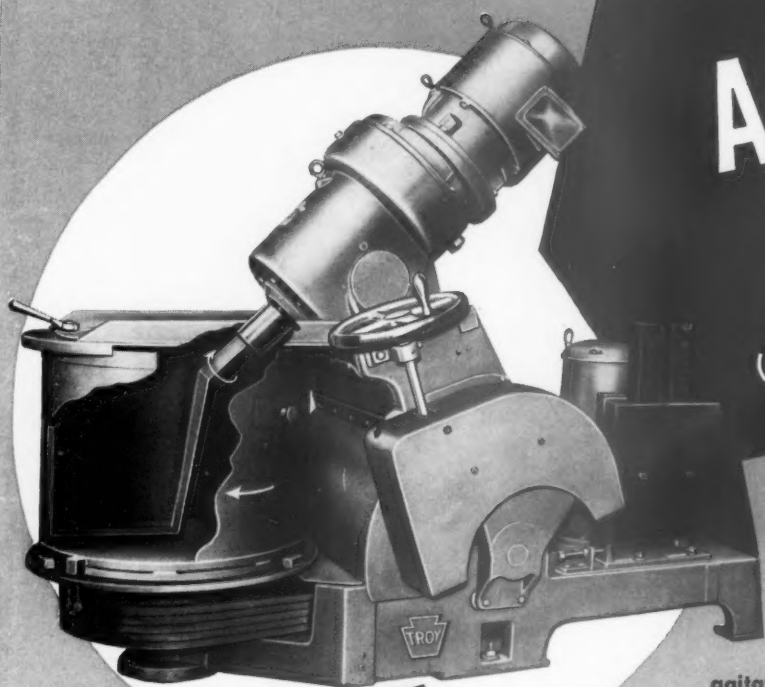


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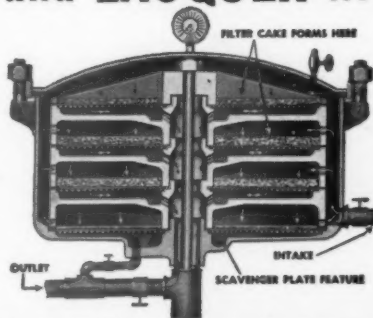
A report of the laboratory study, including directions on preparation of emulsions and suggested formulations, is available on request to the manufacturer. Resinous Products Division of Rohm & Haas Co., Philadelphia, Pa. PVP—April.

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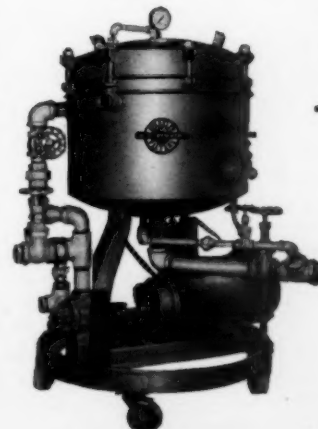
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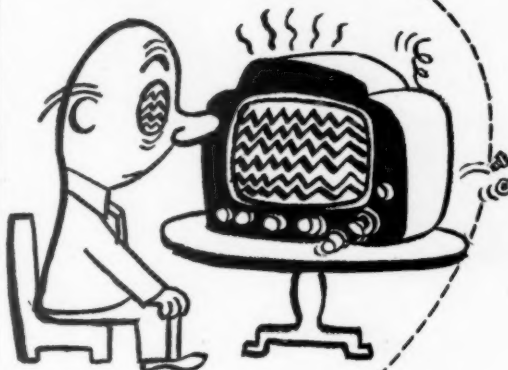
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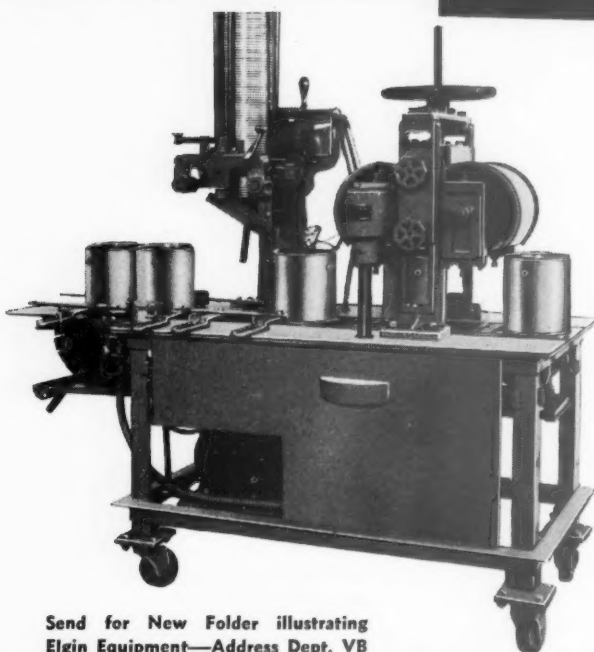
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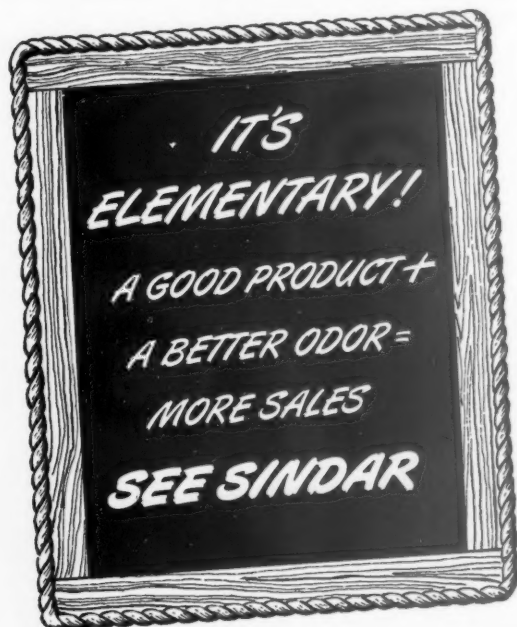
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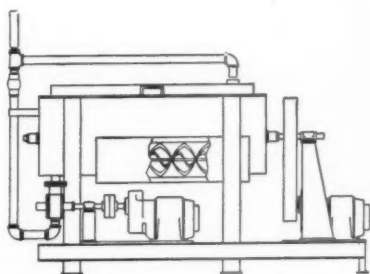
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Ideally adapted to a wide range of applications in the handling of liquids and viscous fluids, these pumps are available in sturdy Naval Bronze Forgings which last indefinitely and will not corrode. This new model was specifically designed to meet the need for a compact, economically-priced pump which would deliver all the advantages normally associated with pumps of larger size. Eco Engineering Co., 12 New York Ave., Newark, N. J. PVP—April.



L. O. KOVEN

### PASTE MIXER

#### Stainless Steel

A 60 gallon, stainless steel, heavy duty paste mixer, will provide a method of supplying paste of uniform consistency, characteristics and temperature under accurate discharging conditions.

The mixer is built with a rectangular mixing tank, having a half round bottom, with inside dimensions of 51" long, 30" wide and 18 1/4" maximum depth. The tank is jacketed on the round bottom for 36" of its length for steam heating at 125 p.s.i. working pressure.

A full-length, stainless steel, ribbon type spiral agitator, with inner and outer ribbons having opposite thrusts, assures thorough mixing action. The agitator shaft is driven, through a 4 to 1 reducing chain drive, at approximately 87 r.p.m. by

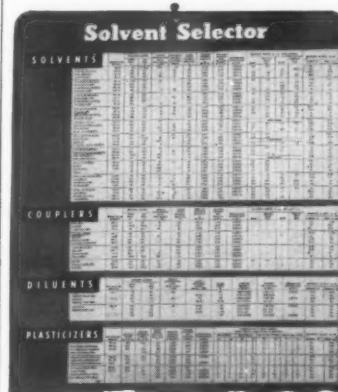
a 2 h.p. gearhead motor mounted on the channel iron base.

The curved cover is hinged for quick and easy access for filling and cleaning purposes. Discharge is made through 1 1/2" discharge opening, employing a rotary pump driven by a 1 1/2 h.p. gearhead motor. Discharge piping has a swivel joint design, making vat or drum loading fast and simple. Spillage losses are kept to a minimum by the use of two pump "start-stop" and "momentary fill" push button controls. A thermometer is located in the discharge line for checking the temperature of the discharging paste. L. O. Koven & Brothers, Inc., 154 Ogden Ave., Jersey City 7, N. J. PVP—April.

### CASEINS

#### High Stability

"Protovac Caseins" are developed to meet special requirements in the fields of leather finishes, paints, paper coatings, sizings, etc. According to the manufacturer these products have been made under controlled conditions to give a completely uniform compound with consistent pH and viscosities. Many grades are soluble in cold water without the addition of alkali and will tolerate formaldehyde without gelling, and remain stable at room temperatures for months. The Borden Co., Chemical Div., 350 Madison Ave., New York, N. Y. PVP—April.



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In Canada: Carbide and Carbon Chemicals, Limited, Toronto

# PATENTS

Conducted by

Lancaster, Allwine &  
Rommel

PATENTS AND COPYRIGHTS

424 Bowen Building,  
Washington, D. C.

Complete copies of any patents or trade-mark registration reported below may be obtained by sending 50c for each copy desired to Lancaster, Allwine & Rommel.

## Paint Mixing Machine

U. S. Patent 2,527,556. Alwin Kost, Portland, Oregon.

A mixing machine comprising a lever; fulcrum means for said lever positioned between the two ends of the lever and closer to one end than the other and supporting said lever for universal movement; receptacle holding means carried by the shorter end portion of said lever; means for moving the other end portion of said lever in a circular path to thereby impart a swash plate movement to said receptacle holding means; a lever oscillating arm positioned approximately at right angles to said lever and radially of said lever; pivot means connecting one end of said lever oscillating arm with said lever the axis of said pivot means being perpendicular to and intersecting the axis of said lever; and pivotally supported socket means slidably supporting the outer end portion of said lever oscillating arm to thereby oscillate said receptacle holding means simultaneously with the swash plate movement thereof.

## Anti-fouling Paints

U. S. Patent 2,533,744. Davis A. Skinner, Compton, and Thomas F. Doumani, Los Angeles, California, assignors to Union Oil Company of California, Los Angeles, Calif., a corporation of California.

An anti-fouling paint composition comprising a paint which is normally subject to fouling by marine organisms when applied to surfaces exposed to marine waters and a copper alkyl mercaptide having from 1 to 7 carbon atoms in an amount sufficient to inhibit said fouling.

## Corrosion Inhibiting Materials

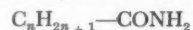
U. S. Patent 2,532,407. Sven Christian Johansson Goteborg, Sweden.

A corrosion inhibiting, surface treating composition consisting essentially of a liquid, metal surface coating agent which is a member of the class consisting of a lubricant, paint, varnish, lacquer, and disinfectant, and containing therein a minor amount of an alkali salt of a nitroparaffin sufficient to impart to said liquid coating agent when applied to the metal surface the capacity to inhibit the corrosion of the metal surface, said nitroparaffin being a member of the class consisting of nitromethane, nitroethane, and nitrophenylnitromethane.

## Aluminum Paste

U. S. Patent 2,525,280. Everett R. Allen, Jersey City, N. J., assignor to Metals Disintegrating Company, Inc., Elizabeth, N. J., a corporation of New Jersey.

An aluminum paste pigment having improved resistance to deterioration of leafing power and comprising aluminum flakes, a liquid hydrocarbon phase and a leafing agent and containing at least about 0.2 to about 5 per cent, of the weight of said metal flakes, of an aliphatic amide represented by the formula



where  $n$  is not less than 13 nor greater than 20, said liquid hydrocarbon phase being a solvent for said amide.

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The NP's possess strong solvent power for the cellulose acetate family of film formers, perfectly filling the demand for good, medium-boiling, flow-promoting solvents in this field.

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Methanol • Amines • Nitroparaffins • Crystalline Riboflavin



### Coating Composition

*U. S. Patent 2,526,439. Jack T. Thurston, Riverside, Conn., assignor to American Cyanamid Company, New York, N. Y., a corporation of Maine.*

A coating composition comprising an aminoplastic resin selected from the group consisting of urea-formaldehyde resins and melamineformaldehyde resins, in a volatile organic dispersion medium, and 1%-5% of a phosphoric acid derivative of a saturated hydroxy aliphatic ester containing 4-8 carbon atoms, wherein said hydroxy group is attached to the acid portion of said ester.

### Polyvinyl Chloride Solutions

*U. S. Patent 2,538,091. Donald Finlayson and Albert William Mortimer Cooke, Spondon, near Derby, England, assignors to Celanese Corporation of America, a corporation of Delaware.*

A solution in a volatile solvent of a polyvinyl chloride which is insoluble in methyl ethyl ketone, said solution containing 3 to 10% by weight of the polyvinyl chloride, said solvent consisting of cyclohexanone diluted with a non-associated liquid of boiling point below 85° C. that is not a solvent for polyvinyl chloride, said liquid containing methyl ethyl ketone, the ratio of said liquid to the cyclohexanone ranging from 5:1 to 40:1 and the ratio of methyl ethyl ketone to polyvinyl chloride being at least 2.4:1, said ratios being by weight.

### Modification of Drying Oils

*U. S. Patent 2,529,528. Gordon M. Williams, Glens Falls, N. Y., assignor to New Wrinkle, Inc., Dayton, Ohio, a corporation of Delaware.*

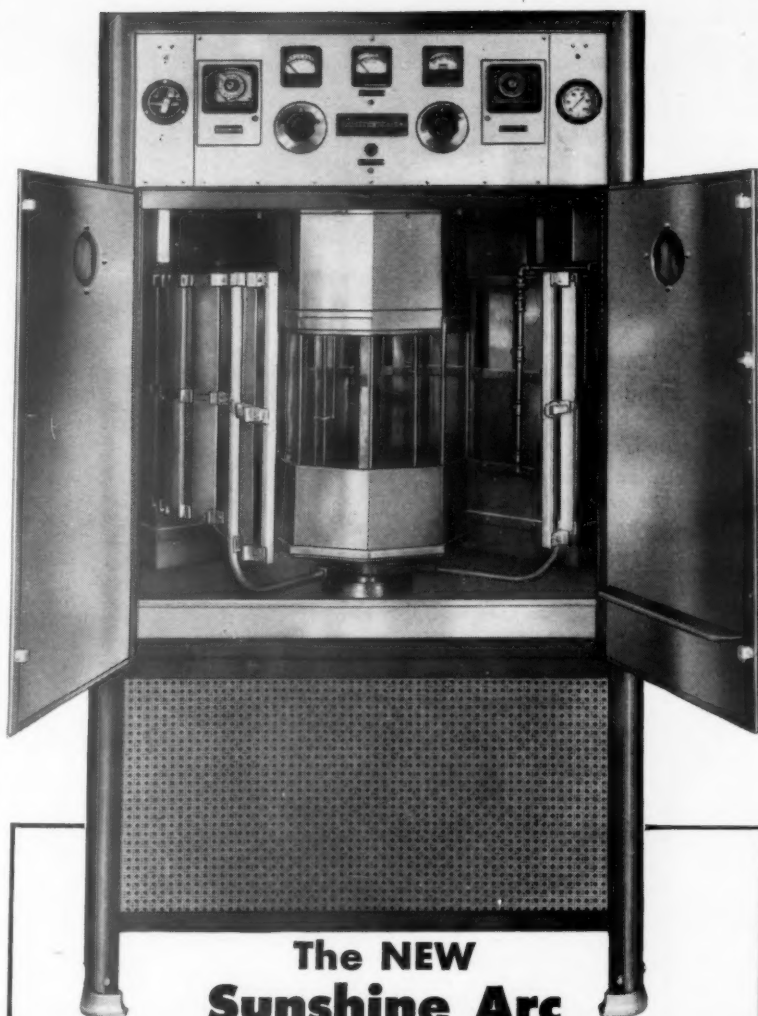
The method of increasing the siccative power of double bonded fatty oils and the fatty acid thereof which comprises, halogenating at least a portion of the double bonds of said fatty compounds and thereafter reacting the halogenated product with a metallo-unsaturated aliphatic compound.

#### LANCASTER, ALLWINE & ROMMEL REGISTERED PATENT ATTORNEYS

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## The NEW Sunshine Arc Weather-Ometer Type XW

**A modernized and redesigned version of the open  
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Many of the control features that have proven their dependability in the Atlas Twin Arc Weather-Ometer have been combined with some features of the original X-1-A weathering unit to make a new Weather-Ometer of advanced design.

In the Type XW a new means of maintaining constant temperature is provided. Far more accurate temperature control is now available.

Radiation is from a Sunshine Carbon Arc which is of the motor-driven, open-flame type. Natural sunlight or intensified ultra-violet radiation is available depending upon the type of carbons and filters used. The light source has been improved to provide 16 hours of continuous operation as well as a number of other added conveniences.

All instruments are located on a convenient control panel, including an arc voltage setting switch and meter, cycle control of light and water spray, 1 to 24 hour shut-down time switch, thermo-regulator and running time meter.

Type XW is fully automatic and may safely be left in unattended operation overnight. If deionized water is to be used, aluminum spray piping can be furnished. The capacity of the stainless steel lined testing chamber is 54 panels. The machine is sturdily constructed and is shipped assembled, ready for connection.

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By all standards, you are assured of maximum production and dependable operation.

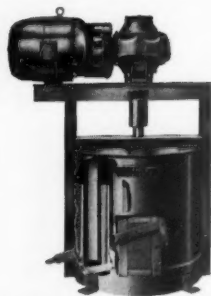
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It will pay you to investigate our REBUILDING AND RECONDITIONING service.



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## CALENDAR OF EVENTS



**April 17-20.** Twentieth National Packaging Exposition of the American Management Association, Auditorium, Atlantic City, N. J.

**April 24.** Association of Consulting Chemists and Chemical Engineers, Shelburne Hotel, New York, N. Y.

**April 27-28.** Annual Joint Meeting of Dallas-Houston Paint and Varnish Production Clubs, Shamrock Hotel, Houston, Texas.

**April 30-May 4.** National Materials Handling Exposition, International Amphitheatre, Chicago, Ill.

**May 24-25.** Society of Plastics Industry Meeting, Greenbrier Hotel, White Sulphur Springs, W. Va.

**June 18-22.** A. S. T. M. Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

**Oct. 22-24.** Thirteenth Annual Forum of the Packaging Institute, Hotel Commodore, New York City, N. Y.

**Oct. 29-31.** National Paint, Varnish and Lacquer Association Convention, Chalfonte-Haddon Hall, Atlantic City, N. J.

**Nov. 1-3.** Federation of Paint and Varnish Production Clubs, Chalfonte-Haddon Hall, Atlantic City, N. J. Paint Industries Show, Oct. 31-Nov. 3.

### CLASSIFIED ADVERTISEMENTS

Rates: \$20 per word, except those seeking employment, for which rate is \$.10 per word. Minimum: ten words. Address all replies to Box Number, c/o Paint and Varnish Production, 855 Avenue of the Americas, New York 1, New York.

**Production Manager.** Paint plant production manager of proven ability desires greater use of capabilities. Not a chemist but thoroughly versed in practical modern production methods and its phases; labor relations, purchasing, cost, sales, office functions, etc. Available July first. Employers advised of this action. Box 109 Paint and Varnish Production.

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## NEWS DIGEST



E. ARNOLD BISBEE

### Falk & Co. Appoints E. A. Bisbee

Announcement has been made by David Lewis, vice president and western manager of Falk & Company, of the appointment of Mr. E. Arnold Bisbee as Manager of Linseed and Soybean Oil sales for the Midwest territory. Mr. Bisbee has recently moved to Chicago to assume his new duties.

Mr. Bisbee is well known in the flax crushing and linseed oil industries, having spent his entire business career in this field. Prior to his association with Falk & Company, Mr. Bisbee was Secretary and a director of the Bisbee Linseed Company of Philadelphia, which had been organized by Messrs. E. C., A. L., and F. J. Bisbee, his father and uncles. He had been associated with that company in Amsterdam, New York, and Philadelphia since 1928. He was a member of the Minneapolis Grain Exchange and the Linseed Advisory Committee of the Department of Agriculture. Mr. Bisbee joined Falk & Company in January 1950 as Branch Manager, when the Philadelphia plant of the Bisbee Linseed Company was acquired by Falk.

### Kilby Resigns as Secretary of American Tung Oil Association

W. W. Kilby of Poplarville, Miss. has resigned as executive secretary of the American Tung Oil Association in order that he may return to tung research with the Mississippi Experiment Station. He will remain as executive secretary until a successor can be appointed.

### Plaskon Names Dr. H. Hoppens Associate Director of Research

Dr. Harold Hoppens has been promoted to the position of associate director of research for Plaskon Division, Libbey-Owens-Ford Glass Company. Hoppens will continue in charge of coating resin's research, in which field he has been engaged since joining Plaskon nine years ago.

### Kenneth Specht Heads National Lead Co. Sales

Kenneth C. Specht has been named manager of trade sales for National Lead Company. He continues as assistant to the manager of sales, paints, pigments and oils of the company.

### Rapids-Standard to Exhibit Equipment at Handling Show

Newest models of Rapistan Material Flow equipment will be exhibited in Booths 154 and 155 during the Fourth Annual Material Handling Exposition in Chicago, April 30 through May 4, 1951. Three types of equipment, vital to every business with handling problems, will be displayed in these booths by The Rapids-Standard Company, Inc., of Grand Rapids, Michigan.

### CSC Appoints Sydney T. Ellis Assistant to the President

Sydney T. Ellis has been appointed assistant to the president of Commercial Solvents Corporation.

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The same high pigment dispersion standards required for top-quality civilian coatings are often necessary for military coatings. Better wetting of the pigment . . . reduction of agglomerates . . . greater color development . . . superior uniformity . . . these are sometimes important factors in meeting government specifications.

Get in touch with R-B-H if you have a dispersion problem connected with specification development work. Our dispersion technicians are on call. Our laboratories are at your disposal. Our plant can make a gallon or fifty drums.

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## NEWS DIGEST



A. E. WHITNEY, JR.

### A. E. Whitney Named Special Representative for Goodyear

Appointment of A. E. Whitney, Jr. as a special representative of the Chemical Division, The Goodyear Tire & Rubber Company, with headquarters in New York, has been announced.

Mr. Whitney will offer technical services to customers in the New England and Middle Atlantic states on Goodyear's Pliovic (vinyl) resins.

Mr. Whitney joins the Goodyear Chemical organization with a wealth of experience in the research, development and production of vinyl in coated fabrics, printing inks and other uses for these resins.

A native of Paterson, N. J., he is a graduate of Nutley, N. J. high school and the Newark College of Engineering with a degree in Chemical engineering. During the war he was actively engaged in work on thin films and coated fabrics at Brooklyn Polytechnic Institute, where considerable work was done by the Quartermaster Corps.

### A. L. Geisinger Named Vice Pres. Of Diamond Alkali Company

Appointment of A. L. Geisinger to a vice presidency in Diamond Alkali Company was announced recently by president Raymond F. Evans following action by the Board of Directors.

In this new role with the company, which he long has served in executive capacities, Mr. Geisinger will have charge of Diamond's activity in the organic chemistry field.

### Rohm & Haas Augments Ohio Development Staff

The Resinous Products Division of Rohm & Haas Co., chemicals manufacturer, has appointed Carl B. Bennett to its field staff in the Ohio area. Working out of Cleveland headquarters, he will complement George T. Sohl in sales and development work with the company's Paraplex polyester resins and plasticizers, Amberlite ion exchange resins, and resins for the rubber industry.

### Calco Appointments

Donald S. Barnes has been appointed sales representative for the Cincinnati territory and R. N. Griswold, formerly Cincinnati Branch Manager, has been named Mid-Central Regional Sales Manager.

### Atlas Mineral Promotes Erich

Atlas Mineral Products Company has announced that Earl Erich, formerly of the Technical Service Department, has been made Product Director for Linings and Coatings.

### M. K. Howlett Heads G-E Silicone Sales

Mark K. Howlett of the General Electric Company's Chemical Department, has been appointed silicone sales supervisor, with headquarters at Watford, N. Y., according to Robert G. Baumann, manager of silicone products sales.

With his new appointment, Mr. Howlett will have direct responsibility for selecting, organizing and directing the silicone field sales organization.



## Here's a More Stable Supply of Polyols!

Abundant agricultural products are the source of Atlas sorbitol—the polyol (polyhydric alcohol) least subject to fluctuations in price and availability. And, now, Atlas is doubling its sorbitol production—a job planned for completion late in 1951.

This means that now is the time to take a look at your future needs for polyols... the time to plan to make the most of the advantages of sorbitol-based vehicles.

Atlas sorbitol offers you demonstrated advantages in the synthesis of hard gums, "in situ" varnishes, tall oil esters, alkyd resins. Sorbitol-based vehicles give you the range of control you want on melting points, viscosities, solubilities in your maleic and phenolic modified resin esters. And sorbitol is a polyol of outstanding purity and color.

Write for the Atlas booklet giving practical formulas and specific directions for making sorbitol-based vehicles. It includes many suggestions for new products.

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#### Metals Disintegrating Company Holds Conference at St. Louis

A most successful two-day meeting of its metal pigments sales organization leaders was held recently at Hotel Jefferson, St. Louis, Mo., by the Metals Disintegrating Company, Elizabeth, N. J., manufacturers of metal pigments, metal powders and metal abrasives.

The conference was opened with a message of welcome and statement of the purpose of the meeting, by H. E. Hall, President and General Sales Manager of M. D., who then turned the chairmanship of the session over to Harold E. Collins, Assistant General Sales Manager of the company. Key personnel from the entire country were present to participate in a program in which was detailed the latest sales and technical data about the company's products and markets. (See above photo.)

#### Glidden Promotions

Promotion of Robert P. Morris to the position of Related Products Manager was recently announced by Alexander D. Duncan, vice president in charge of the Paint and Varnish Division of The Glidden Company.

At the same time, Mr. Duncan announced the appointment of Andrew J. Duncan to succeed Mr. Morris as executive assistant.

#### Materials Handling Exposition

The most extensive discussion of materials handling problems, a phase of industry which now involves upwards of 25 per cent of production payrolls, has been announced for the Materials Handling Conference to be held at the International Amphitheatre, Chicago. The conference will be held during three of the five days of the fourth National Materials Handling Exposition, April 30 to May 4, inclusive.

The conference will be sponsored by the American Material Handling Society and the exposition by the Material Handling Institute. Clapp and Poliak, Inc., New York, will conduct the exposition.

#### Moyer Heads Technical Sales Of McCloskey Varnish in Chicago

Mr. H. B. Almond, vice-president and director of sales has announced the appointment of Mr. George H. Moyer as technical sales manager of the Chicago Division.

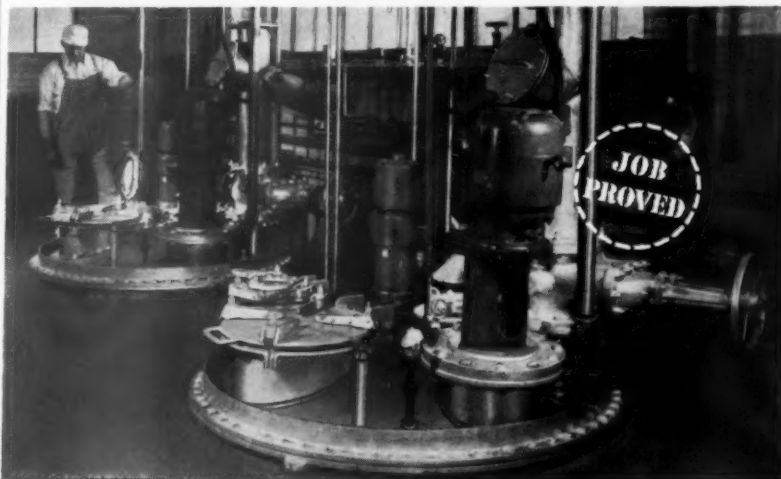
#### A. C. Nispel Representing Troy Machine in New England

A. C. Nispel, Inc. of 131 Beverly St., Boston 4, Mass. is now representing the Troy Engine and Machine Company in the New England area. Troy's line includes roller mills, colloid mills and mixers.

#### Monsanto Appointments

L. W. Miller was appointed branch manager of the special products department of Monsanto Chemical Company's Western Division.

Mr. Miller will succeed W. P. Willis, Jr., who has been named plant manager of the company's Santa Clara, Calif., operations. Mr. Miller has been serving as senior sales representative of the special products department.



## UNTARNISHED VARNISH RECORD

**Noted Manufacturer Gives Large Share of Credit to Uniformity and High Solvency of Sun Spirits**

One of the country's principal varnish manufacturers rates Sun Spirits as one of the big factors contributing to his success. Proud of his record for even-drying, high gloss, durable finishes, he has used this "Job Proved" solvent for more than 21 years. He has nothing but praise for its exceptional uniformity and high solvency.

Sun Spirits is a carefully balanced product. It has good wetting-out power. Volatility is controlled to in-

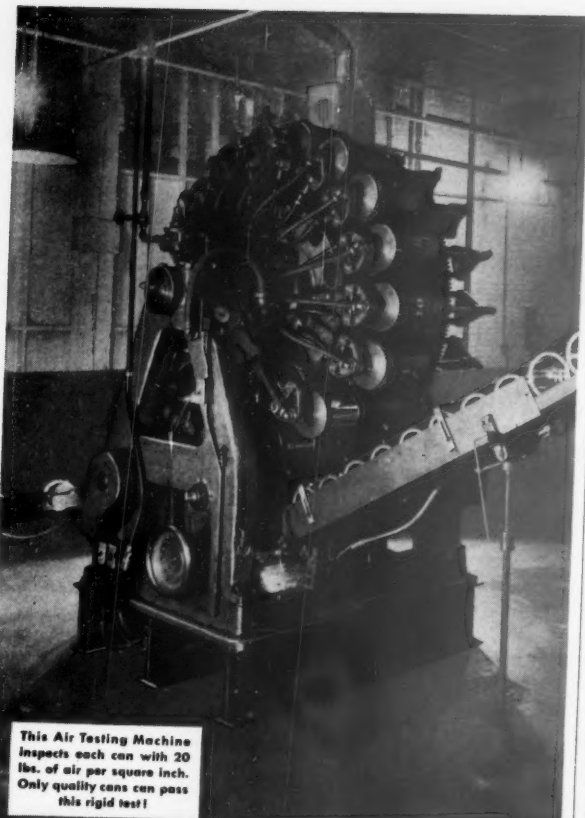
sure a rate of drying that is neither too fast nor too slow. Purity is checked and rechecked to make certain of a reliable, high-quality product. In new formulas, as well as old, and in experimenting with new materials, rely on the uniformity and quality of Sun Spirits. For full information, get in touch with your nearest Sun Office.

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Every Davies can is individually inspected with the best testing equipment. Paint manufacturers using Davies cans are assured of the *ultimate* in product protection... As specialists in paint containers, the entire facilities of Davies Can are at the *exclusive* service of the paint industry... For the finest in cans and the best of service, get in touch with Davies!

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A high oil absorption  
Zinc Oxide  
having large  
Acicular Particles  
which gives  
heavy body.

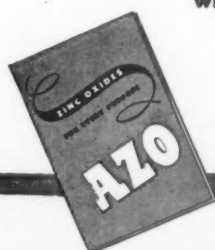


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A medium oil absorption  
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weathering qualities  
to exterior paints.

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A definitely Acicular type with a  
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with AZO ZZZ-11 and AZO ZZZ-22.



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oxides. Ask for your copy now.

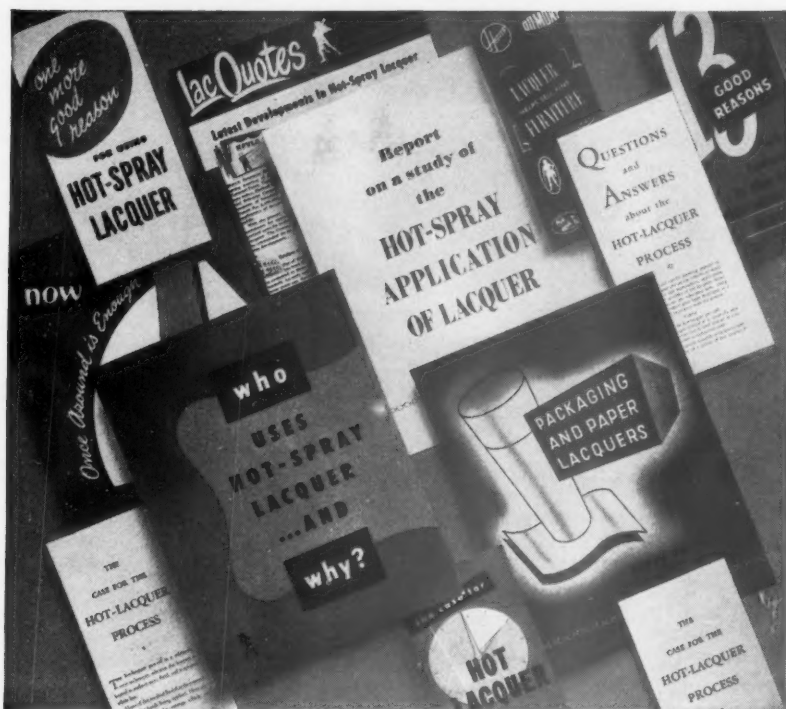
*low*



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Here are a dozen booklets with up-to-date information especially prepared to help you tell industry about recent advancements in lacquer technology. The new and rapidly developing market for hot-spray lacquers is outlined in the survey report, "Who Uses Hot-Spray Lacquer and Why." Other literature describes modern lacquer's merits in the packaging, paper, furniture, and automotive fields. You'll want copies for your files and quantities are available for distribution to your customers. Let these informative sales aids do work for you.



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Every Paint manufacturer using Water-Ground Mica should be using "CONCORD" because:

- 1—It is ground exclusively from a clean, white Muscovite Mica scrap imported from India and Africa.
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☐ Technical Data

Name \_\_\_\_\_ Title \_\_\_\_\_

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# particle size

		MASS		TONE		Loading Capacity	Covering Power	Total Surface Activity	Nature of Surface		
GRADE	Brackman Index	Particle size microns	Channel Blacks Area		No. of Particles per 100 sq. in.	Covering Power Index	100% Coverage Index	Oil Soluble Matter %	Ash %	Analysis Moisture Free	
			Black per %	Grey per %						Fixed Carbon %	Volatile Matter %
CHANNEL BLACKS	Neo Spectra Mark I	240	10	29.4	26.7	280	95	100	2.9	83.8	16.2
	Neo Spectra Mark II*	220	13	22.5	20.1	257	93	65	3.0	85.3	14.7
	Super Spectra	216	13	22.5	20.1	277	93	66	4.2	92.1	7.9
	Neo Spectra Mark III	194	18	18.3	14.6	110	81	90	2.8	87.0	13.0
	Superba*	191	18	18.3	14.6	180	95	65	3.2	90.0	10.0
	Excelsior*	166	21	14.8	12.5	122	100	75	3.7	94.8	5.2
FURNACE BLACKS	No. 140 Black	160	24	12.2	10.8	107	96	23	3.2	92.3	7.7
	Raven 11*	157	25	11.7	10.5	103	95	17	3.5	93.8	6.2
	Statex B-12*	118	43	6.8	6.1	85	82	3	9.3	99.4	0.6
	Statex*	95	50	5.9	5.5	66	68	4	10.0	99.2	0.8
	Molacco*	58	83	1.9	1.1	47	56	2	10.1	99.5	0.5

\*Also manufactured in Beaded form

In developing required color intensity  
particle size is the controlling factor.



\* COLUMBIAN COLLOIDS \*



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